



Contents lists available at ScienceDirect

Journal of Adolescence

journal homepage: www.elsevier.com/locate/jado



Academic well-being and smoking among 14- to 17-year-old schoolchildren in six European cities



Jaana M. Kinnunen ^{a,*}, Pirjo Lindfors ^{a,b}, Arja Rimpelä ^{a,b,c},
Katariina Salmela-Aro ^{d,e}, Katharina Rathmann ^f, Julian Perelman ^g,
Bruno Federico ^h, Matthias Richter ^f, Anton E. Kunst ⁱ, Vincent Lorant ^j

^a School of Health Sciences, FI-33014 University of Tampere, Finland

^b PERLA – Tampere Centre for Childhood, Youth and Family Research, FI-33014 University of Tampere, Finland

^c Department of Adolescent Psychiatry, Tampere University Hospital, Pitkänieni Hospital, FI-33380 Nokia, Finland

^d Department of Psychology, PO Box 35, FI-40014 University of Jyväskylä, Finland

^e Cicero Learning, PO Box 9, FI-00014 University of Helsinki, Finland

^f Institute of Medical Sociology, Medical Faculty, Martin Luther University Halle-Wittenberg, Magdeburger Str. 8, 06112 Halle (Saale), Germany

^g Escola Nacional de Saúde Pública and Centro de Investigação em Saúde Pública, Universidade Nova de Lisboa, Avenida Padre Cruz, 1600-560 Lisboa, Portugal

^h Department of Human Sciences, Society and Health, University of Cassino and Southern Lazio, Via S. Angelo snc, Campus Folcara, 03043 Cassino (FR), Italy

ⁱ Department of Public Health, Academic Medical Centre, University of Amsterdam, PO Box 22660, 1100 DD Amsterdam, The Netherlands

^j Institute of Health and Society, Université Catholique de Louvain, Clos chapelle aux champs 30 /B1.30.15.05, 1200 Bruxelles, Belgium

ARTICLE INFO

Article history:

Keywords:

Adolescence

Smoking

School

School burnout

Schoolwork engagement

Academic performance

ABSTRACT

It is well established that poor academic performance is related to smoking, but the association between academic well-being and smoking is less known. We measured academic well-being by school burnout and schoolwork engagement and studied their associations with smoking among 14- to 17-year-old schoolchildren in Belgium, Germany, Finland, Italy, the Netherlands, and Portugal. A classroom survey (2013 SILNE survey, N = 11,015) was conducted using the Short School Burnout Inventory and the Schoolwork Engagement Inventory. Logistic regression, generalized linear mixed models, and ANOVA were used. Low schoolwork engagement and high school burnout increased the odds for daily smoking in all countries. Academic performance was correlated with school burnout and schoolwork engagement, and adjusting for it slightly decreased the odds for smoking. Adjusting for socioeconomic factors and school level had little effect. Although high school burnout and low schoolwork engagement correlate with low academic performance, they are mutually independent risk factors for smoking.

© 2016 The Authors. Published by Elsevier Ltd on behalf of The Foundation for Professionals in Services for Adolescents. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

* Corresponding author. Tel.: +358 40 190 1667.

E-mail addresses: jaana.m.kinnunen@staff.uta.fi (J.M. Kinnunen), pirjo.lindfors@uta.fi (P. Lindfors), arja.rimpela@uta.fi (A. Rimpelä), katariina.salmela-aro@helsinki.fi (K. Salmela-Aro), katharina.rathmann@medizin.uni-halle.de (K. Rathmann), jperelman@ensp.unl.pt (J. Perelman), b.federico@unicas.it (B. Federico), m.richter@medizin.uni-halle.de (M. Richter), A.Kunst@amc.uva.nl (A.E. Kunst), vincent.lorant@uclouvain.be (V. Lorant).

Introduction

Academic performance and its relationship to adolescent smoking have been widely studied. Students who perform better academically are less likely to smoke, while those whose performance is weak smoke much more often (Bryant, Schulenberg, Bachman, O'Malley, & Johnston, 2000; Pennanen, Haukkala, De Vries, & Vartiainen, 2011; Schnohr, Kreiner, Rasmussen, Due, & Diderichen, 2009). Poor subjective health and factors related to well-being are also known to be related to adolescent smoking (Botello-Harbaum, Haynie, Murray, & Iannotti, 2010; Holmen, Barrett-Connor, Holmen, & Bjerner, 2000; Rius, Fernandez, Schiaffino, Borràs, & Rodríguez-Artalejo, 2004; Vingilis, Wade, & Seeley, 2002). However, it is not well known how school-related aspects of well-being, specifically academic well-being, relate to smoking.

In our study, academic well-being is measured by the concepts of school burnout and schoolwork engagement, which have been suggested to be central indicators of well-being at school (Tuominen-Soini, Salmela-Aro, & Niemivirta, 2012). Burnout was originally recognized as a work-related disorder (Maslach, Jackson, & Leiter, 1996), and in the context of school, it has only been studied over the last decade (Walburg, 2014). School-related burnout has been defined as a combination of exhaustion from schoolwork, cynicism about the meaning of school, and a sense of inadequacy as a student (Salmela-Aro, Kiuru, Leskinen, & Nurmi, 2009), and it can be caused by discrepancies among students' internal resources, school workload and expectations of school results (Kiuru, Aunola, Nurmi, Leskinen, & Salmela-Aro, 2008).

The term "school engagement" has been in use since the late 1980s, and it typically describes a multidimensional construct that includes psychological, academic, affective, cognitive and behavioral components (Upadaya & Salmela-Aro, 2013). Its origin is in work-life studies (Schaufeli, Martinez, Pinto, Salanova, & Bakker, 2002). The concept of school engagement has mainly been applied in North America. Recently, a somewhat different approach, schoolwork engagement, was developed in Europe that focuses more on emotional (energy for schoolwork), cognitive (dedication toward schoolwork and a perception that schoolwork is meaningful), and behavioral (absorption in schoolwork so that time passes quickly when studying) dimensions (Upadaya & Salmela-Aro, 2013). Academic well-being and academic performance are intertwined: Good academic performance is positively related to schoolwork engagement (Salmela-Aro & Upadaya, 2012) and negatively related to school burnout (Salmela-Aro, Kiuru, et al., 2009).

The association of school burnout and schoolwork engagement with smoking has not been studied before. Regarding the North American concept of school engagement, a few studies have shown that high school engagement can promote healthy behavior and protect against health-compromising behaviors, such as smoking (Carter, McGee, Taylor, & Williams, 2007; Wang & Fredricks, 2014). Wang and Fredricks (2014) have observed that adolescents with declines in behavioral and emotional engagement with school had increased substance use (tobacco, alcohol, and marijuana).

Research aims

We studied the association between academic well-being, measured by school burnout and schoolwork engagement, and daily smoking among 14- to 17-year-old schoolchildren in six medium-sized European cities. Because academic performance is an important risk factor for smoking and is related to academic well-being, we are also presenting results on academic performance and are exploring whether it explains or modifies the association between academic well-being and smoking.

Method

Participants and study procedure

We used data that were collected with the Smoking Inequalities - Learning from Natural Experiments (SILNE) school survey between February and November 2013. The participants were 14- to 17-year-old students ($n = 11,015$) from six European cities (country): Namur (Belgium), Hannover (Germany), Tampere (Finland), Latina (Italy), Amersfoort (the Netherlands) and Coimbra (Portugal). Questionnaires were administered during regular school hours using a paper-and-pencil method and were sealed in envelopes immediately after completion. The answers were entered into a web platform by the responsible institution of each country. The overall response rate was 79.4%, but it varied from 66.0% in Hannover (GE) to 89.8% in Namur (BE). Active parental consent was required in Latina (IT) and Hannover (GE). More information on the SILNE survey can be found elsewhere (Lorant et al., 2015).

In each city, two school grades covering 14- to 17-year-old students were selected because smoking and the transition from experimentation to regular smoking increase rapidly at these ages (Dierker, Swendsen, Rose, He, & Merikangas, 2012). All students in these grades were invited to participate, leading to an age range of 12–19 years among participants. For these analyses, students who were 12, 13, 18 and 19 years old ($n = 424$) and students with missing information on age ($n = 81$) were excluded to keep the age variation as compact as possible because smoking increases rapidly across this age span. Students with missing information on smoking ($n = 185$) were also excluded, leading to a study population of 10,325 individuals. Of the study population, 52.4% were girls and 47.6% were boys. In all cities, the proportions of boys and girls were relatively equal except in Latina (IT), where girls comprised 59.8% of the study population. The characteristics of the study population are presented in Table 1.

Table 1

Mean age (years); percentage (%) of daily smoking and high academic performance; and mean, standard deviation (SD), skewness, kurtosis and alpha of school burnout^a and schoolwork engagement^b by city (n = number of participants).

Variable	All (n = 10,325)	Namur (BE) (n = 1962)	Tampere (FI) (n = 1480)	Hannover (GE) (n = 1312)	Latina (IT) (n = 1996)	Amersfoort (NL) (n = 1844)	Coimbra (PT) (n = 1731)
Mean age, years	15.19	15.46	14.82	14.81	15.11	15.02	15.77
Daily smoking, %	14.5	18.4	11.9	9.8	20.7	8.9	14.3
School burnout ^a							
Mean (SD)	3.08 (1.24)	3.13 (1.27)	3.06 (1.21)	3.22 (1.24)	3.21 (1.30)	3.17 (1.14)	2.68 (1.17)
Skewness	.23	.25	.28	.10	.15	.13	.45
Kurtosis	-.60	-.62	-.44	-.65	-.73	-.54	-.41
Alpha	.624	.623	.576	.635	.667	.460	.725
Schoolwork engagement ^b							
Mean (SD)	2.11 (1.43)	2.00 (1.37)	3.00 (1.28)	1.58 (1.33)	1.95 (1.44)	1.89 (1.34)	2.25 (1.44)
Skewness	.09	.20	-.79	.58	.28	.21	-.07
Kurtosis	-1.16	-.98	-.13	-.68	-1.05	-1.07	-1.20
Alpha	.759	.673	.848	.782	.719	.781	.827
High academic performance, %	40.7	39.0	33.2	31.1	54.2	40.5	40.5

^a School burnout was measured by the mean of two items on a scale of 1–6. In F post hoc tests between each city, the differences were statistically significant ($p < .01$) between Tampere (FI) and Hannover (GE), Tampere (FI) and Latina (IT), and Coimbra (PT) and all other cities.

^b Schoolwork engagement was measured by the mean of three items on a scale of 0–5. The differences in F post hoc tests between each city were all statistically significant ($p < .001$) except between Namur (BE) and Latina (IT), Namur (BE) and Amersfoort (NL), and Latina (IT) and Amersfoort (NL).

Measures

Smoking

Smoking experience was assessed on the basis of adolescents' self-reported answers to the question "Have you ever tried cigarette smoking, even just a few puffs?" (No/Yes). Those who answered "Yes" were then asked "How many cigarettes have you smoked during the last 30 days?" Reporting having smoked at least one cigarette per day was recorded as daily smoking. Questions on smoking were adopted from the 2010–2011 Youth Smoking Survey (YSS, 2011), and they have also been used in the Global Youth Tobacco Survey (GYTS, 2016).

School burnout

School burnout was assessed with the Short School Burnout Inventory (SSBI), which was developed from a validated instrument, the School Burnout Inventory (SBI; Salmela-Aro, Kiuru, et al., 2009). The SSBI has been used previously, and its psychometric properties have been tested (Salmela-Aro, Kiuru, Pietikäinen, & Jokela, 2008). The SSBI contains three items that measure the three dimensions of school burnout: (1) a sense of inadequacy at school (*I often have feelings of inadequacy about my schoolwork*), (2) cynicism toward the meaning of school (*I feel that I am losing interest in my schoolwork*), and (3) exhaustion at school (*I brood over matters related to my schoolwork a lot during my free time*). Each item is measured on a 6-point scale (1 = Completely disagree to 6 = Completely agree). A higher score indicates a higher level of burnout. Cronbach's alpha (reliability of the three-item scale) was .379. The reliability between item 3 and the first two items was particularly low, but for items 1 and 2, Cronbach's alpha and the Spearman–Brown coefficient were .624, which is acceptable. These two items formed the final school burnout scale in the analyses, and they measure well the clinical components of burnout, and therefore they separate students according to school burnout level (Salmela-Aro, Kiuru, et al., 2009). Mean, skewness and kurtosis of the scale as well as Cronbach's alpha were calculated for the whole sample and for each city (Table 1). For Amersfoort (NL), Cronbach's alpha was lower than it was for the other cities (.460).

For the analyses, the mean of these two items was calculated to measure school burnout. For the logistic regression analyses, school burnout was categorized into three groups according to the mean: ≤ 1.50 = low, 2.00–4.00 = average, and ≥ 4.50 = high. The average group comprised 67.0% of the respondents, with 14.9% in the low group, and 18.1% in the high group. Participants who did not answer both items were excluded from the analysis (2.6%).

Schoolwork engagement

Schoolwork engagement was estimated with a short version of a validated scale, the Schoolwork Engagement Inventory (EDA; Salmela-Aro & Upadaya, 2012), which captured three dimensions: (1) absorption (*Time flies when I am studying*), (2) energy (*I feel strong and vigorous when I am studying*), and (3) dedication (*I am enthusiastic about my studies*). It was scored on a 6-point scale (0 = Never to 5 = Daily). For the analyses, the mean of the three items was calculated, with a higher score indicating a higher level of engagement. For the logistic regression analyses, schoolwork engagement was categorized into three groups according to the mean: ≥ 4.00 = high, 1.00–3.67 = average, and $\leq .67$ = low. The average group comprised 60.6% of the respondents, with 24.3% in the low group, and 15.1% in the high group. Participants who did not answer all three items were excluded from the analysis (3.1%). Cronbach's alpha (reliability of the three-item scale) was .759. The mean, skewness and kurtosis of the scale as well as Cronbach's alpha were calculated for the whole sample and for each city (Table 1). For Namur (BE), Cronbach's alpha was lower than for the other cities (.673).

Academic performance and other variables

Academic performance was assessed by asking “Which of the following best describes your school marks during the past year?” The options were adapted for each country; e.g., in Belgium, the options were Généralement des TB, Généralement des B, Généralement des S, Généralement des F, and Généralement des I, while in Italy, they were 9–10, 7–8, Per lo più 6, 4–5, and Minore di 4. A student's grades on a school report reflect a teacher's assessment of the performance of that student. Therefore, school performance reported by the student reflects factual information from the student's school reports. Although the measurement instrument varied among countries, in each country, it separated students into categories based on whether their school performance was relatively high or low. The team in every country determined the categories of ‘high, average and low’ based on their measurement instrument or the distribution of students. In the whole sample, the high category comprised 40.7% of the respondents, the average category comprised 41.7%, and the low category comprised 17.6%.

Socioeconomic variables were included in the analyses as controlling variables because they are associated with both smoking (Green, Leyland, Sweeting, & Benzeval, 2014) and academic performance (Sun & Li, 2001). The Family Affluence Scale (FAS) was constructed to measure adolescents' socioeconomic status using four questions (Currie et al., 2008). Adolescents' subjective social status has been found to be associated with several health measures (Karvonen & Rahkonen, 2011) and was estimated with the youth version of the McArthur scale, which is a ladder that asks students to rank their family's social status at a scale from 10 (best off) to 0 (worst off) (Goodman et al., 2001). A binary variable of the McArthur scale was calculated as the individual score minus the mean score of the country. Scores below zero were defined as low socioeconomic status, and scores greater than or equal to zero were defined as high socioeconomic status. Parents' highest level of education was asked for both the father and the mother. The question was adapted for each country, but for the analyses, a common four-category variable was used: high, middle, low and do not know/other.

Statistical analyses

Descriptive statistics and distributional properties of the scales were calculated in the pooled data and separately for each city. To test the differences between cities in terms of school burnout and schoolwork engagement, the F-test was performed along with pairwise post hoc tests between cities. School burnout, schoolwork engagement and academic performance were then cross-tabulated with daily smoking.

Next, the associations in the pooled data were studied using logistic regression analyses. Age and gender were adjusted for in all models. In Model 1, school burnout, schoolwork engagement and academic performance were taken into the model separately. In Model 2, these variables were taken in the model simultaneously. The interaction terms of school burnout and academic performance, schoolwork engagement and academic performance, and school burnout and schoolwork engagement were then added into the model, but because they were not significant, they were not included in Model 3. In Model 3, the FAS, the MacArthur scale and parents' education were first added into the model, followed by the interaction terms of city and school burnout, city and schoolwork engagement, and city and academic performance.

To assess the variance between schools in terms of school burnout and schoolwork engagement, we used ANOVA. School explained 10% of the variance for schoolwork engagement and 4% for school burnout, and therefore, school level was adjusted for in Model 4 along with the individual-level variables from Model 3. The analysis was conducted with generalized linear mixed models. All analyses were conducted with IBM SPSS Statistics V.21.0.

Results

Table 1 presents the descriptive statistics for the whole sample and for each city. The differences between the cities were statistically significant in terms of school burnout, with $F(5, 10,049) = 46.71, p < .001$, and schoolwork engagement, with $F(5, 10,003) = 177.80, p < .001$. Pairwise differences between cities are shown in the footnote to Table 1. School burnout was higher among girls (3.11 ± 1.23) than boys (3.04 ± 1.25), with $F(1, 10,025) = 6.18, p = .013$, and in all cities except Coimbra (PT). Correspondingly, girls were more engaged with schoolwork (2.27 ± 1.40) than were boys (1.93 ± 1.44), with $F(5, 9977) = 140.32, p < .001$, and girls were also more engaged than boys in each city.

In the correlation analyses, high school burnout was positively correlated to low schoolwork engagement ($r = -.316$) and low academic performance ($r = .265$), and low schoolwork engagement was positively correlated to low academic performance ($r = .192$).

Daily smoking was most common among those who had a high level of school burnout, a low level of schoolwork engagement and low academic performance (Table 2). Correspondingly, daily smoking was least common among those whose level of school burnout was low, who were strongly engaged with their schoolwork and who performed well at school. The same pattern was found in each city.

In age- and gender-adjusted logistic regression analyses, both school well-being variables and academic performance were significantly associated with smoking (Table 3, Model 1). The associations weakened somewhat when all three variables were taken into the model simultaneously (Model 2), but the associations still remained statistically significant. The interaction terms of academic performance and school burnout ($p = .284$), academic performance and schoolwork engagement ($p = .302$), and school burnout and schoolwork engagement ($p = .209$), which were added in Model 2, were not statistically

Table 2

Prevalence, % (n), of daily smoking by school burnout, schoolwork engagement and academic performance among all participants and by city, and p-value.

Variable	All	Namur (BE)	Tampere (FI)	Hannover (GE)	Latina (IT)	Amersfoort (NL)	Coimbra (PT)
School burnout							
Low	9.1 (136)	16.0 (40)	3.4 (7)	5.3 (9)	12.4 (35)	7.0 (14)	8.1 (31)
Average	13.1 (883)	16.9 (211)	10.0 (100)	9.3 (78)	18.2 (223)	6.9 (88)	16.0 (183)
High	22.6 (411)	23.3 (85)	24.3 (60)	14.8 (39)	31.9 (139)	17.6 (60)	16.5 (28)
p-Value	<.001	.013	<.001	.003	<.001	<.001	<.001
Schoolwork engagement							
High	7.3 (111)	10.6 (24)	5.9 (27)	7.1 (7)	11.6 (32)	3.9 (6)	4.9 (15)
Average	12.7 (772)	16.6 (196)	12.8 (109)	8.4 (59)	17.5 (201)	5.7 (66)	13.8 (141)
Low	22.7 (551)	26.6 (121)	23.4 (30)	12.5 (56)	31.7 (167)	18.1 (91)	23.4 (86)
p-Value	<.001	<.001	<.001	.049	<.001	<.001	<.001
Academic performance							
High	8.0 (329)	13.2 (99)	1.7 (8)	2.7 (11)	10.6 (114)	6.2 (46)	7.8 (51)
Average	15.6 (653)	18.3 (132)	8.0 (42)	11.3 (72)	30.1 (229)	9.0 (81)	14.9 (97)
Low	25.0 (443)	26.6 (119)	26.0 (112)	18.4 (46)	47.2 (68)	17.3 (34)	20.9 (64)
p-Value	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Table 3

Age- and gender-adjusted odds ratio (OR) and 95% confidence interval (CI) for daily smoking by school burnout, schoolwork engagement and academic performance in four different models in all cities.

Variable	Model 1	Model 2	Model 3	Model 4
School burnout				
Low	1.00	1.00	1.00	1.00
Average	1.51 (1.25, 1.83)	1.23 (1.01, 1.52)	1.27 (1.03, 1.58)	1.31 (1.06, 1.63)
High	2.98 (2.41, 3.68)	1.88 (1.49, 2.37)	1.88 (1.48, 2.38)	1.98 (1.55, 2.52)
Schoolwork engagement				
High	1.00	1.00	1.00	1.00
Average	1.79 (1.45, 2.21)	1.53 (1.23, 1.91)	1.60 (1.27, 2.01)	1.59 (1.27, 2.00)
Low	3.60 (2.89, 4.48)	2.65 (2.10, 3.35)	2.76 (2.17, 3.52)	2.74 (2.15, 3.49)
Academic performance				
High	1.00	1.00	1.00	1.00
Average	1.91 (1.65, 2.20)	1.64 (1.41, 1.90)	1.63 (1.40, 1.91)	1.63 (1.40, 1.90)
Low	3.11 (2.65, 3.66)	2.47 (2.09, 2.93)	2.35 (1.96, 2.80)	2.31 (1.93, 2.76)

Model 1: School burnout, schoolwork engagement and academic performance separately, age- and gender-adjusted.

Model 2: School burnout, schoolwork engagement and academic performance at the same time, age- and gender-adjusted.

Model 3: Model 2 adjusted for FAS, MacArthur scale and parents' education.

Model 4: Model 3 adjusted for school level as a random effect.

Note: the odds ratio (OR) is in bold when it indicates a statistically significant ($p \leq .05$) difference from the OR of the reference category.

significant. Adjusting for socioeconomic background (Model 3) as well as school level (Model 4) changed the odds ratios only slightly. In separate analyses for boys and girls (Table 4), the relationships remained for both genders.

The interactions between city and school burnout, city and schoolwork engagement, and city and academic performance were added to Models 1 to 3. These all were statistically significant ($p \leq .05$), and therefore, Table 5 presents the city-specific odds ratios in two models. The basic pattern was similar for all cities (Model 1). When school burnout, schoolwork engagement and academic performance were taken into the model simultaneously, and the socioeconomic background of the family and school level were adjusted for, the strength of the associations decreased in most cases, and some of the statistical significances disappeared (Table 5, Model 4).

In addition to daily smoking, we tested the number of cigarettes that were smoked as a dependent variable in Models 1 and 2. The findings were similar to those of daily smoking.

Discussion

Our results showed that a high level of school burnout and a low level of schoolwork engagement, in addition to low academic performance, were strong risk factors for daily smoking.

Comparison with previous studies

The association between schoolwork engagement and smoking has not been studied previously. However, a related concept, school engagement, has been associated with smoking, and low school engagement has been associated with a higher risk of smoking (Carter et al., 2007; Wang & Fredricks, 2014).

The association between school burnout and smoking has also not been studied previously. Because of this lack of previous studies, we compared our results with those of studies on depressive symptoms and smoking. School burnout

Table 4

Age-adjusted odds ratio (OR) and 95% confidence interval (CI) for daily smoking among boys and girls by school burnout, schoolwork engagement and academic performance in all cities.

Variable	Model 1		Model 4	
	Boys	Girls	Boys	Girls
School burnout				
Low	1.00	1.00	1.00	1.00
Average	1.34 (1.04, 1.73)	1.76 (1.31, 2.36)	1.27 (.92, 1.74)	1.62 (1.11, 2.36)
High	2.33 (1.74, 3.10)	3.87 (2.82, 5.31)	1.84 (1.28, 2.65)	2.56 (1.70, 3.88)
Schoolwork engagement				
High	1.00	1.00	1.00	1.00
Average	1.81 (1.32, 2.49)	1.76 (1.33, 2.32)	1.55 (1.06, 2.27)	1.56 (1.11, 2.20)
Low	3.00 (2.17, 4.16)	4.37 (3.25, 5.88)	2.47 (1.66, 3.67)	3.09 (2.12, 4.49)
Academic performance				
High	1.00	1.00	1.00	1.00
Average	1.68 (1.36, 2.07)	2.13 (1.75, 2.58)	1.56 (1.22, 2.00)	1.88 (1.48, 2.38)
Low	2.66 (2.12, 3.33)	3.63 (2.89, 4.55)	2.13 (1.61, 2.82)	2.49 (1.86, 3.35)

Model 1: School burnout, schoolwork engagement and academic performance separately, age- and gender-adjusted.

Model 4: School burnout, schoolwork engagement and academic performance at the same time, adjusted for age, gender, FAS, MacArthur scale and parents' education and school level as a random effect.

Note: the odds ratio (OR) is in bold when it indicates a statistically significant ($p \leq .05$) difference from the OR of the reference category.

Table 5

Age- and gender-adjusted odds ratio (OR) and 95% confidence interval (CI) for daily smoking in each city by school burnout, schoolwork engagement and academic performance in two models.

Variable	Namur (BE)	Tampere (FI)	Hannover (GE)	Latina (IT)	Amersfoort (NL)	Coimbra (PT)
Model 1						
School burnout						
Low	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.07 (.74, 1.57)	3.13 (1.43, 6.84)	1.78 (.86, 3.70)	1.59 (1.08, 2.35)	1.06 (.59, 1.91)	1.86 (1.24, 2.79)
High	1.60 (1.04, 2.46)	9.09 (4.05, 20.40)	2.96 (1.36, 6.41)	3.26 (2.15, 4.94)	2.96 (1.59, 5.51)	1.88 (1.08, 3.28)
Schoolwork engagement						
High	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.70 (1.07, 2.69)	2.31 (1.49, 3.58)	1.19 (.52, 2.76)	1.69 (1.12, 2.53)	1.41 (.60, 3.32)	2.92 (1.68, 5.07)
Low	3.21 (1.98, 5.22)	4.69 (2.65, 8.29)	2.00 (.86, 4.66)	3.69 (2.42, 5.63)	4.94 (2.11, 11.58)	5.12 (2.85, 9.18)
Academic performance						
High	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.33 (.99, 1.78)	5.38 (2.49, 11.62)	3.57 (1.85, 6.89)	3.33 (2.59, 4.30)	1.35 (.92, 1.97)	1.66 (1.15, 2.41)
Low	1.87 (1.38, 2.55)	22.66 (10.8, 47.55)	5.49 (2.73, 11.03)	6.21 (4.19, 9.23)	2.70 (1.66, 4.38)	2.19 (1.43, 3.36)
Model 4						
School burnout						
Low	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.04 (.69, 1.58)	4.06 (1.21, 13.63)	1.74 (.72, 4.18)	1.34 (.86, 2.10)	1.27 (.66, 2.42)	1.52 (.94, 2.44)
High	1.47 (.91, 2.37)	6.57 (1.87, 23.12)	2.15 (.84, 5.50)	2.00 (1.23, 3.26)	2.90 (1.44, 5.83)	1.25 (.65, 2.40)
Schoolwork engagement						
High	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.86 (1.12, 3.09)	1.27 (.77, 2.10)	.77 (.31, 1.95)	1.61 (1.02, 2.56)	1.15 (.44, 3.02)	2.79 (1.49, 5.25)
Low	3.38 (1.97, 5.81)	1.54 (.77, 3.08)	1.18 (.46, 2.99)	2.49 (1.51, 4.10)	3.20 (1.21, 8.46)	4.47 (2.25, 8.85)
Academic performance						
High	1.00	1.00	1.00	1.00	1.00	1.00
Average	1.23 (.89, 1.69)	4.35 (1.89, 10.01)	5.28 (2.29, 12.17)	2.45 (1.83, 3.27)	.91 (.60, 1.41)	1.59 (1.06, 2.38)
Low	1.44 (1.01, 2.05)	14.61 (6.33, 33.75)	7.62 (3.12, 18.66)	3.42 (2.16, 5.41)	1.44 (.82, 2.52)	2.00 (1.25, 3.21)

Model 1: School burnout, schoolwork engagement and academic performance separately, age- and gender-adjusted.

Model 4: School burnout, schoolwork engagement and academic performance at the same time, adjusted for age, gender, FAS, MacArthur scale, parents' education and school level as a random effect.

Note: the odds ratio (OR) is in bold when it indicates a statistically significant ($p \leq .05$) difference from the OR of the reference category.

has been closely related to depressive symptoms in longitudinal studies (Salmela-Aro, Savolainen, & Holopainen, 2009), and depressive symptoms have been used as a concurrent validity measure for school burnout (Salmela-Aro, Kiuru, et al., 2009). In earlier studies, depressive symptoms were associated with smoking (Steuber & Danner, 2006; Torikka, Kaltiala-Heino, Rimpelä, Rimpelä, & Rantanen, 2001), which reflects our results on the relationship between school burnout and smoking.

Our study confirmed previous findings that associated low academic performance with a higher likelihood of smoking among adolescents (Bryant et al., 2000; Pennanen et al., 2011; Schnohr et al., 2009). Our study also confirmed previous findings of positive correlations among school burnout, schoolwork engagement and academic performance (Salmela-Aro & Upadaya, 2012; Salmela-Aro, Kiuru, & Nurmi, 2008).

Interpretation of the results

The association between academic well-being and smoking remained when adolescents' socioeconomic background and academic performance were controlled for. Our results suggest that school burnout, schoolwork engagement, and academic performance are mutually independent risk factors for adolescent smoking. A recent study revealed that emotional engagement in school and school burnout are separate and distinct psychological processes that contribute independently to adolescents' academic and psychological outcomes (Wang, Chow, Hofkens, & Salmela-Aro, 2015).

There are several explanations for why academic well-being and smoking are associated. First, the self-system model (a motivational framework based on the self-determination theory) (Deci & Ryan, 2000) states that the extent to which adolescents are engaged in school builds a motivational context that enables them to deal with difficulties and failures in school (Skinner & Pitzer, 2012). Consequently, students who fail to engage to school may seek solace in problem behaviors, such as smoking, which in turn may exacerbate their disengagement with school (Bachman et al., 2008). Wang and Fredricks (2014) showed that the association between school engagement and problem behavior is bidirectional: changes in adolescents' substance use are predicted by their early level of school engagement, and changes in school engagement are predicted by early substance use.

Second, adolescents' investments in health and education include a trade-off between current costs and future benefits (Fuchs, 1982). It can be assumed that individuals who are more present-oriented are less likely to invest in their future health and education: they smoke more, are less engaged in schoolwork, and have a higher level of school burnout and lower academic performance. In addition, it can be speculated that the association between academic well-being and smoking reflects the attitudes and values of adolescents' families, which affects adolescents' engagement with schoolwork and their education and school burnout (see, e.g., Carter et al., 2007; Steinberg, Lamborn, Dornbusch, & Darling, 1992).

Third, our study analyzed the associations on an individual level, but the observed associations could be reinforced by processes at a group level and in networks within schools. Group-level and network theories explaining adolescent smoking (Hoffman, Sussman, Unger, & Valente, 2006) suggest the selection of peers and the formation of friendship groups by such characteristics as smoking (DeLay, Laursen, Kiuru, Salmela-Aro, & Nurmi, 2013; Hoffman, Monge, Chou, & Valente, 2007), academic performance (Kiuru, Nurmi, Aunola, & Salmela-Aro, 2009), school burnout (Kiuru et al., 2008) and school engagement (Kindermann, 2007). Subcultures in schools, e.g., groups of adolescents with poor school success, cynicism, feelings of inadequacy about schoolwork (burnout), and less interest in schoolwork (engagement), may induce exposed students to participate in risk-taking and non-normative behaviors.

Strengths and limitations

Our study has many strengths. Academic well-being was measured with the same school survey design and instruments in the same age groups. The sample selection was as similar as possible, and the study was conducted in the same year in each city. In addition, the number of participants was large, and the participation rate was high.

There are also some limitations in our study. We cannot exclude the possibility that the differences between the cities in the level of school burnout and schoolwork engagement are related to differences in the validity of the survey instruments that we used in different cultural settings. These instruments have not been used in cross-cultural studies before. However, an instrument with small problems in validity may still give valid results regarding the relationship with smoking. Different educational systems and classifications of academic performance resulted in different proportions of high academic performance among the countries, which may have affected the results. The higher proportion of high academic performance in Latina (IT) may be related to a higher proportion of girls among their participants because in many cases, girls get higher grades.

We were not able to control for externalizing behaviors (aggression, delinquency or hyperactivity; Liu, 2004), which are known to be associated with both smoking (King, Iacono, & McGue, 2004; Modesto-Lowe, Danforth, Neering, & Easton, 2010) and low academic performance (Hinshaw, 1992). Because school adjustment has been found to mediate the association between attention deficit/hyperactivity disorder (ADHD) symptoms and smoking (Flory, Malone, & Lamis, 2011), these externalizing behaviors can be considered possible confounders for the association between academic well-being and smoking. However, the prevalence is not very high, e.g. for ADHD with medication, the estimated prevalence is 4.8% of children between 4 and 17 years of age (Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014).

Although the selected cities in each country were average ones, we cannot exclude the possibility that some of the cities may not represent the entire country. The varying response rates among countries is also a limitation. The somewhat lower response rates in Germany and Italy were due to the requirement for active parental consent in these countries. Finally, we used self-reported data, and smoking behavior may be underreported due to the desire to provide socially acceptable answers in the classroom (Krumpholtz, 2013), leading to an underestimation of smoking and its association with school burnout, schoolwork engagement and academic performance. In this study, smoking was not cross-checked by biochemical methods, but previous studies on adolescents' self-reporting about smoking have been shown to be accurate and in agreement with biochemical measures (Dolcini, Adler, Lee, & Bauman, 2003; Kentala, Utriainen, Pahkala, & Mattila, 2004; Post et al., 2005).

Despite these limitations, our study showed a similar pattern in associations between academic well-being and smoking across six European cities, which likely reflects a general pattern in Europe. However, more studies are needed to verify the

generalizability of these findings and to advance the comparisons internationally. Longitudinal designs would provide better answers that could reveal the causality and pathways behind these associations.

Conclusions

Our results show a strong association between students' poor academic well-being and daily smoking. In addition to academic performance, academic well-being is an important factor in shaping students' health behaviors. To the extent that these associations reflect a causal effect, they may imply that promoting children's academic well-being in the early school years—that is, increasing their engagement with schoolwork and lowering their feelings of inadequacy and cynicism toward school—could provide a buffer against smoking. In a way, such a strategy could help to “kill two birds with one stone” by preventing smoking and improving academic performance.

Funding

This study was part of the project ‘Tackling socio-economic inequalities in smoking (SILNE)’, which was financed by the European Commission under the Seventh Framework Programme, grant identification number 278273. The funding source had no involvement in the study design; the collection, analysis or interpretation of the data; the writing of the report; or the decision to submit the article for publication.

Acknowledgements

We thank the adolescents and schools in Namur, Tampere, Hannover, Latina, Amersfoort and Coimbra for participating in the SILNE survey. We also thank American Journal Experts for editing the manuscript.

References

- Bachman, J. G., O'Malley, P. M., Schulenberg, J. E., Johnston, L. D., Freedman-Doan, P., & Messersmith, E. E. (2008). *The education–drug use connection: How successes and failures in school relate to adolescent smoking, drinking, drug use, and delinquency*. Mahwah, NJ: Erlbaum.
- Botello-Harbaum, M., Haynie, D. L., Murray, K. W., & Iannotti, R. J. (2010). Cigarette smoking status and recurrent subjective health complaints among US school-aged adolescents. *Child: Care, Health and Development*, 37(4), 551–558.
- Bryant, A., Schulenberg, J., Bachman, J. G., O'Malley, P. M., & Johnston, L. D. (2000). Understanding the links among school misbehavior, academic achievement, and cigarette use: a national panel study of adolescents. *Prevention Science*, 1(2), 71–87.
- Carter, M., McGee, R., Taylor, B., & Williams, S. (2007). Health outcomes in adolescence: associations with family, friends and school engagement. *Journal of Adolescence*, 30(1), 51–62.
- Currie, C., Molcho, M., Boyce, W., Holstein, B., Torsheim, T., & Richter, M. (2008). Researching health inequalities in adolescents: the development of the Health Behaviour in School-Aged Children (HBSC) Family Affluence Scale. *Social Science and Medicine*, 66, 1429–1436.
- Deci, E. L., & Ryan, R. M. (2000). What is the self in self-directed learning? Findings from recent motivational research. In G. Staka (Ed.), *Conceptions of self-directed learning: Theoretical and conceptual considerations* (pp. 75–92). Munster, Germany: Waxmann.
- DeLay, D., Laursen, B., Kiuru, N., Salmela-Aro, K., & Nurmi, J.-E. (2013). Selecting and retaining friends on the basis of cigarette smoking similarity. *Journal of Research on Adolescence*, 23(3), 464–473.
- Dierker, L., Swendsen, J., Rose, J., He, J., & Merikangas, K. (2012). Transitions to regular smoking and nicotine dependence in the Adolescent National Comorbidity Survey (NCS-A). *Annals of Behavioral Medicine*, 43, 394–401.
- Dolcini, M. M., Adler, N. E., Lee, P., & Bauman, K. E. (2003). An assessment of the validity of adolescent self-reported smoking using three biological indicators. *Nicotine & Tobacco Research*, 5(4), 473–483.
- Flory, K., Malone, P. S., & Lamis, D. A. (2011). Childhood ADHD symptoms and risk for cigarette smoking during adolescence: school adjustment as a potential mediator. *Psychology of Addictive Behaviors*, 25(2), 320–329.
- Fuchs, V. R. (1982). Time preference and health: an exploratory study. In V. R. Fuchs (Ed.), *Economic aspects of health* (pp. 93–120). Chicago, IL: University of Chicago Press.
- Goodman, E., Adler, N. E., Kawachi, I., Frazier, A. L., Huang, B., & Colditz, G. A. (2001). Adolescents' perceptions of social status: development and evaluation of a new indicator. *Pediatrics*, 108, e31.
- Green, M. J., Leyland, A. H., Sweeting, H., & Benzeval, M. (2014). Socioeconomic position and early adolescent smoking development: evidence from the British Youth Panel Survey (1994–2008). *Tobacco Control*. <http://dx.doi.org/10.1136/tobaccocontrol-2014-051630>. Published Online First: 7 November 2014.
- GYTS. (2016). Global youth tobacco survey. Retrieved 12.04.16 from World Health Organisation website <http://www.who.int/tobacco/surveillance/gyts/en/>.
- Hinshaw, S. P. (1992). Externalizing behavior problems and academic underachievement in childhood and adolescence: causal relationships and underlying mechanisms. *Psychological Bulletin*, 111(1), 127–155.
- Hoffman, B. R., Monge, P. R., Chou, C.-P., & Valente, T. W. (2007). Perceived peer influence and peer selection on adolescent smoking. *Addictive Behaviors*, 32, 1546–1554.
- Hoffman, B. R., Sussman, S., Unger, J. B., & Valente, T. W. (2006). Peer influences on adolescent cigarette smoking: a theoretical review of the literature. *Substance Use and Misuse*, 41, 1–53.
- Holmen, T. L., Barrett-Connor, E., Holmen, J., & Björner, L. (2000). Health problems in teenage daily smokers versus nonsmokers, Norway, 1995–1997. The Nord-Trøndelag Health Study. *American Journal of Epidemiology*, 151(2), 148–155.
- Karvonen, S., & Rahkonen, O. (2011). Subjective social status and health in young people. *Sociology of Health and Illness*, 33(3), 372–383.
- Kentala, J., Urtiainen, P., Pakkala, K., & Mattila, K. (2004). Verification of adolescent self-reported smoking. *Addictive Behaviors*, 29(2), 405–411.
- Kindermann, T. A. (2007). Effects of naturally existing peer groups on changes in academic engagement in a cohort of sixth graders. *Child Development*, 78(4), 1186–1203.
- King, S. M., Iacono, W. G., & McGue, M. (2004). Childhood externalizing and internalizing psychopathology in the prediction of early substance use. *Addiction*, 99(12), 1548–1559.
- Kiuru, N., Aunola, K., Nurmi, J.-E., Leskinen, E., & Salmela-Aro, K. (2008). Peer group influence and selection in adolescents' school burnout: a longitudinal study. *Merrill-Palmer Quarterly*, 54(1), 23–55.

- Kiuru, N., Nurmi, J.-E., Aunola, K., & Salmela-Aro, K. (2009). Peer group homogeneity in adolescents' school adjustment varies according to peer group type and gender. *International Journal of Behavioral Development*, 33(1), 65–76.
- Krumpal, I. (2013). Determinants of social desirability bias in sensitive surveys: a literature review. *Quality & Quantity*, 47(4), 2025–2047.
- Liu, J. (2004). Childhood externalizing behavior: theory and implications. *Journal of Child and Adolescent Psychiatric Nursing*, 17(3), 93–103.
- Lorant, V., Soto, V. E., Alves, J., Federico, B., Kinnunen, J., Kuipers, M., et al. (2015). Smoking in school-aged adolescents: design of a social network survey in six European countries. *BMC Research Notes*, 8, 91.
- Maslach, C., Jackson, S. E., & Leiter, M. P. (1996). *The Maslach Burnout Inventory. Manual* (3rd ed.). Palo Alto, CA: Consulting Psychologists Press.
- Modesto-Lowe, V., Danforth, J. S., Neering, C., & Easton, C. (2010). Can we prevent smoking in children with ADHD: a review of the literature. *Connecticut Medicine*, 74(4), 229–236.
- Pennanen, M., Haukkala, A., De Vries, H., & Vartiainen, E. (2011). Longitudinal study of relations between school achievement and smoking behavior among secondary school students in Finland: results of the ESFA study. *Substance Use & Misuse*, 46(5), 569–579.
- Polanczyk, G. V., Willcutt, E. G., Salum, G. A., Kieling, C., & Rohde, L. A. (2014). ADHD prevalence estimates across three decades: an updated systematic review and meta-regression analysis. *International Journal of Epidemiology*, 43(2), 434–442.
- Post, A., Gilljam, H., Rosendahl, I., Meurling, L., Bremberg, S., & Galanti, M. R. (2005). Validity of self reports in a cohort of Swedish adolescent smokers and smokeless tobacco (snus) users. *Tobacco Control*, 14, 114–117.
- Rius, C., Fernandez, E., Schiaffino, A., Borrás, J. M., & Rodríguez-Artalejo, F. (2004). Self perceived health and smoking in adolescents. *Journal of Epidemiology & Community Health*, 58, 698–699.
- Salmela-Aro, K., Kiuru, N., Leskinen, E., & Nurmi, J.-E. (2009). School-Burnout Inventory (SBI). Reliability and validity. *European Journal of Psychological Assessment*, 25(1), 48–57.
- Salmela-Aro, K., Kiuru, N., & Nurmi, J.-E. (2008). The role of educational track in adolescents' school burnout: a longitudinal study. *British Journal of Educational Psychology*, 78(4), 663–689.
- Salmela-Aro, K., Kiuru, N., Pietikäinen, M., & Jokela, J. (2008). Does school matter? The role of school context in adolescents' school-related burnout. *European Psychologist*, 13(1), 12–23.
- Salmela-Aro, K., Savolainen, H., & Holopainen, L. (2009). Depressive symptoms and school burnout during adolescence: evidence from two cross-lagged longitudinal studies. *Journal of Youth and Adolescence*, 38, 1316–1327.
- Salmela-Aro, K., & Upadaya, K. (2012). The schoolwork Engagement Inventory. Energy, Dedication, and Absorption (EDA). *European Journal of Psychological Assessment*, 28(1), 60–67.
- Schaufeli, W. B., Martinez, I., Pinto, A. M., Salanova, M., & Bakker, A. (2002). Burnout and engagement in university students: a cross-national study. *Journal of Cross-Cultural Psychology*, 33, 464–481.
- Schnohr, C., Kreiner, S., Rasmussen, M., Due, P., & Diderichen, F. (2009). School-related mediators in social inequalities in smoking: a comparative cross-sectional study of 20,399 adolescents. *International Journal for Equity in Health*, 8, 17.
- Skinner, E. A., & Pitzer, J. (2012). Developmental dynamics of engagement, coping, and everyday resilience. In S. Christenson, A. Reschly, & C. Wylie (Eds.), *The handbook of research on student engagement* (pp. 21–44). New York, NY: Springer Science.
- Steinberg, L., Lamborn, S. D., Dornbusch, S. M., & Darling, N. (1992). Impact of parenting practices on adolescent achievement: authoritative parenting, school involvement, and encouragement to succeed. *Child Development*, 63, 1266–1281.
- Steuber, T. L., & Danner, F. (2006). Adolescent smoking and depression: which comes first? *Addictive Behaviors*, 31(1), 133–136.
- Sun, Y., & Li, Y. (2001). Marital disruption, parental investment, and children's academic achievement. *Journal of Family Issues*, 22(27), 27–61.
- Torikka, A., Kaltiala-Heino, R., Rimpelä, A., Rimpelä, M., & Rantanen, P. (2001). Depression, drinking, and substance use among 14- to 16-year-old Finnish adolescents. *Nordic Journal of Psychiatry*, 55, 351–357.
- Tuominen-Soini, H., Salmela-Aro, K., & Niemivirta, M. (2012). Achievement goal orientations and academic well-being across the transition to upper secondary education. *Learning and Individual Differences*, 22, 290–305.
- Upadaya, K., & Salmela-Aro, K. (2013). Development of school engagement in association with academic success and well-being in varying social contexts. A review of empirical research. *European Psychologist*, 18(2), 136–147.
- Vingilis, E. R., Wade, T. J., & Seeley, J. S. (March–April 2002). Predictors of adolescent self-rated health. Analysis of the National Population Health Survey. *Canadian Journal of Public Health*, 193–197.
- Walburg, V. (2014). Burnout among high school students: a literature review. *Children and Youth Services Review*, 42, 28–33.
- Wang, M.-T., Chow, A., Hofkens, T., & Salmela-Aro, K. (2015). The trajectories of student emotional engagement and school burnout with academic and psychological development: findings from Finnish adolescents. *Learning and Instruction*, 36, 57–65.
- Wang, M.-T., & Fredricks, J. A. (2014). The reciprocal links between school engagement, youth problem behaviors, and school dropout during adolescence. *Child Development*, 85(2), 722–737.
- YSS. (2011). Youth smoking survey. Retrieved 12.04.16 from <https://uwaterloo.ca/canadian-student-tobacco-alcohol-drugs-survey/sites/ca.canadian-student-tobacco-alcohol-drugs-survey/files/uploads/files/2010-11.english.module.A.10.08.06.pdf>.